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dr inż. Ewa Siemianowska, dr inż. Monika Radzymińska
dr Agnieszka Kosewska
University of Warmia and Mazury in Olsztyn

ALTERNATIVE SOURCE OF PROTEIN AND AN ELEMENT OF SUSTAINABLE FOOD PRODUCTION

Introduction

The United Nations Food and Agriculture Organization estimates that there will be 9 billion people by the year 2050. This rapid growth of the human population in the second half of the 21st century may cause food deficits, especially a shortage of animal protein. Soon the world will face the problem of supplying all people with quality food[1].

In an era of rapid population growth and vigorous development, with the accompanying ecodegradation and climate warming, a need arises to produce high quality food whose production will not require large energy inputs nor place a heavy burden on the environment. Experts from various fields of science have devoted more and more attention to this issue, as evidenced for example by a meeting convened by FAO on the initiative which took place in Rome between 23 and 25 January 2012. There, a possible solution was the use of insects as food[2]. Later on, in May 2014, a conference was organized at the University of Wageningen (the Netherlands) including experts from all disciplines of science and dedicated exclusively to the question of using insects as quality food in the world. The conference was titled Insects to Feed the World[3].

In the current situation, the European Union has allocated large amounts of money to studying the nutritive value of insects and developing suitable processing technologies to ensure that safe and high quality foodstuffs are made from insects used as alternatives to meat from farm animals. Over the recent years,

[1] J. Mitsuhashi, *The future use of insects as human food*, In: P.B. Durst, D.V. Johnson, R.N. Leslie, K. Shono, *Forest insects as food: humans bite back*, Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific. 2010, pp 115-122.
[2] *Assessing the Potential of Insects as Food and Feed in assuring Food Security*, FAO Report, Technical Consultation Meeting, 23-25 January 2012, FAO: Rome, Italy 2012.
[3] *Insects to feed the world*, Summary Report 1st International Conference 14-17 May 2014, Wageningen (Ede), Wageningen University and Research Centre, The Netherlands 2014.

knowledge has expanded and the number of scientific reports has grown regarding the high nutritive value of insects[4,5]. Nevertheless, more information is still needed concerning possible toxicity and allergenicity of insect-based food for humans, as this food differs from traditional foodstuffs in its composition and nutritive value[6, 7].

The widespread presence and short breeding period mean that the rearing of insects is much more efficient than the keeping of traditional meat livestock. In addition, insect rearing does not demand high energy inputs. The reason is the fact that insects are much more efficient in converting plant biomass to protein than large farm animals[8]. The breeding of insects is not as noxious to the environment either, because it does not generate the large amounts of waste products or greenhouse gases produced on swine, cattle, or poultry farms[9]. Insect production has many advantages including higher efficiency, lower energy requirements, and less waste compared to farm animals[10]. In line with the sustainable development strategy, while civilization is developing dynamically, resulting in progressing ecodegradation and climate warming, it is important to consider how to produce high quality foodstuffs for the continually growing human population[11,] Insects are a missing ecological link in the sustainable economic turnover[12].

[4] A.B. Rumpold, O. K. Schluter, *Nutritional comp of edible insects*, Mol. Nutr. Food Res. 2013, 57, pp 802–823.
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In response to the currently manifested trends of using alternative sources of proteins in food production, it is necessary to conduct research on the demand for these types of food products. The research presented in the following paper is an attempt to identify consumers' attitudes toward unconventional raw materials in food production, including alternative protein sources in the human diet.

Materials and methods

Recognition of consumer attitudes to using insects for making food products was based on a pilot qualitative study. The qualitative study was carried out using focus group interviews. Each meeting lasted for about 2,5 hours. Participants were 25 to 30 years of age. There were two focus sessions guided by a moderator that consisted of free discussions of questions raised regarding the general scenario during each meeting. The sessions focused on the participants perception and emotional attitude towards insects as raw material for food production. The study used the free association technique, in which respondents finished sentences with free associations, feelings, etc. Each session was recorded with an audio-visual recording device from which transcripts were made of the meeting.

Results and discussion

Table 1 contains some quotations of the responses given by the interviewees, arranged into the scenario's problem blocks. The interviewed groups were heterogenous to the extent that they are open to consuming dishes from other cuisines. In each group, there were both conservative and experimenting, innovative consumers. The respondents indicated that they had cooked meals originating from other national cuisines, mainly from ingredients available in nearby supermarkets. Some participants considered themselves to be 'connoisseurs' of regional products only in their country of origin. In general, consumers indicated that when they eat new dishes and food products they pay attention to the ingredients. However, there were also persons who claimed that the awareness of the ingredients did not deter them from trying new foodstuffs. For example, one participant suggested that 'when they see how it is cooked, what it smells and looks like, they imagine what it will taste like and then they do not ponder what is inside the dish.'

The qualitative approach to the research allowed us to identify consumer attitudes to products containing alternative proteins sources in their composition. The respondents admitted that they had not eaten food products that contained such ingredients as insects. There was only one respondent who stated that he/she eats yoghurts which contain an addition of insects, saying 'I don't know if you are aware that one of the dyes in yoghurts is cochineal red from abdomens of African flies'. In all respondents, words like 'an insect', 'a bug' or 'a worm' caused

negative emotions, although the word ‘insect’ was thought to be ‘milder’, ‘not as disgusting as a bug’. The word ‘bug’ caused aversion and was connoted with diseases, dirt, pests, or as ‘a worm’ with something ugly and slimey and to do with angling. Positive emotions were evoked by photographs shown to respondents which illustrated dumplings filled with the filling made of insects, a cricket coated in chocolate, candied ants, protein bars with grain weevil. The vast majority of the respondents declared they would be inclined to eat these products.

Likewise, most of the respondents gave a positive answer to the question: ‘If it was proven that insect-based foods were of high nutritive value, would you be persuaded to taste such foods?’ However, the way these dishes are served and their aesthetic image were reported as an essential condition: ‘if they were served as shown in the photographs’, ‘the shashliks looked quite tasty’, ‘in nice circumstances, a romantic dinner with wine’, ‘if it was such a large caterpillar, I wouldn’t eat it, but if it were small ones, well roasted, I might give it a try’, ‘I’d start by having a small bite, but I suspect that bite after bite I’d eat it all.’

The study demonstrated that the awareness of the nutritive value of insects and the knowledge of rational advantages of insect consumption were poor. Once the moderator informed the survey participants that the UE allocated large funds to research on using unconventional sources of protein in food production and made them aware of the nutritive value of such products, the interviewees agreed that insects could become a staple component of the diets of Europeans, but not necessarily Poles. Most of the opinions regarding Polish eating habits were that insect-based food would be eaten sporadically and chosen spontaneously (for example ‘this will not be eaten on a regular basis in Poland, but chosen spontaneously’). Such products will be bought on condition that they are healthy, palatable, and look appetizing. The respondents suggested that likely consumers would be young people, and those willing to introduce such food products to their children (for example, ‘I have a nine-month-old baby son and if I started adding such products to his diet now he would get used to them and would choose them by himself later in his life’).

Table 1. Some of the opinions given by participants of focused group interviews
Tabela 1. Przykłady wypowiedzi uczestników zogniskowanych wywiadów grupowych

Experimenting with dishes from other cuisines Eksperymentowanie z potrawami innych kuchni - while abroad I did not dare taste shrimp or octopus. I felt disgusted. Once I saw at the Old Market a man holding an octopus and it wrapped its tentacles around his arm, and the following day I was served a dish made from octopus - będąc za granicą nie odważyłam się posmakować, ani krewetki ani ośmiornic. Jakoś tak odrzucało mnie to. Jak widziałam w old Markecie, jak taki pan przy chłodni trzymał taką ośmiornicę i ona oplatała mu te swoje macki na ręce to- nie, a następnego dnia podano właśnie danie z ośmiornicy to nie. - I prefer traditional dishes although I sometimes eat dishes of the Mediterranean or Chinese kitchen

- wolę tradycyjne potrawy, choć zdarza mi się jadać potrawy kuchni śródziemnomorskiej i chińskiej
- I love theme weeks in Lidl, like Italian week, Greek week, …
- ja uwielbiam w Lidlu jak są tygodnie tematyczne włoskie, greckie,…
- the Mediterranean diet is not for me, I am allergic …
- dieta śródziemnomorska nie jest dla mnie, mam nietolerancję…
- I love dishes from other countries, I love experimenting
- uwielbiam potrawy innych kuchni, uwielbiam eksperymentować
- I love travel just because of regional cuisines
- kocham podróże ze względu na regionalne kuchnie
-I am a traditionalist
- jestem tradycjonalistą
- dishes from other kitchens but only in the countries of origin …
- potrawy innych kuchni tak, ale tylko w danym kraju…

Attitude towards dishes with no ingredients identified

Zachowania względem dań bez wyszczególnionych składników

- I can eat a dish as long as I know what it was made from and what was added to it
- zjadam danie tylko w przypadku jak wiem z czego jest zrobione, co tam dodano
- when I see how it is made, what it smells and looks like, I imagine the taste and I reach for it without giving a thought about the ingredients
- widząc, jak to jest przyrządzane, jak to pachnie i jak wygląda, wyobrażam sobie jak to smakuje i wtedy po to sięgam, nie zastanawiając się co jest w środku
- being aware of what's inside would trouble me, I'd rather not know…
- świadomość co jest w środku mi przeszkadza, wolę nie wiedzieć…
- I eat dishes that I know the composition of…
- spożywam dania, tylko w przypadku kiedy wiem jaki jest ich skład…

Opinions about products containing alternative protein sources

Opinie badanych dotyczące produktów zawierających alternatywne źródła białka

- if I knew that the dish I've eaten contains insects, even if it was tasty, I wouldn't eat it again
- gdybym dowiedziała się, że w zjedzonej potrawie są owady, nawet jak byłoby smaczne, nie sięgnęłabym po nią ponownie
- if it was a caterpillar specifically I wouldn't eat it again. Not even if I liked the taste but I found out what it was afterwards I wouldn't have it again
- jakby to konkretnie była gąsienica to raczej bym drugi raz tego nie zjadł. Nawet jakby mi smakowała i po fakcie bym się dowiedział, już drugi raz bym tego nie zjadł
- if it was such a large caterpillar I wouldn't eat it, but small and well roasted ones I might give it a try
- gdyby to była taka duża gąsienica to bym nie zjadła, a takie małe dobrze wypieczone to może bym się skusiła
- this knowledge can be disturbing to some people
- ta świadomość niektórym przeszkadza
- I don't know if you've read ingredients of yoghurt, which after all contain cochineal red from abdomens of African flies
- nie wiem czy czytaliście dodatek barwników w jogurtach tam jest przecież czerwień koszenilinowa z odwłoków muszek afrykańskich
- I'd have to persuade myself to bite into it but if it was good I wouldn't mind eating it all
- musiałbym się przekonać żeby go ugryźć i jak by był dobry to bym nie miał oporów
- I might eat it but with my eyes closed
- z zamkniętymi oczami może bym zjadła
- if I made myself eat it and if I liked it, I would most probably serve it to my children
- gdybym sama się przekonała i by mi to smakowało to pewnie bym podała to swoim dzieciom

- if I persuaded myself then yes, I would taste some
- gdybym sama się najpierw przekonała to wtedy tak, mogłabym skosztować
- a friend of mine who travels around the world has eaten many dishes made from insects, especially in the east of Asia but he wasn't fond of all of them. He has also eaten crickets. Crunching them between teeth was unpleasant but it's a question of getting used to it
- kolega, który podróżuje po świecie, konsumował wiele potraw właśnie z owadów, zwłaszcza na wschodzie w Azji i nie wszystkie mu smakowały. Świerszcze też jadł. Nieprzyjemne jest to wrażenie trzeszczenia między zębami. Jest to kwestia przyzwyczajeń
- if we had grown in such a culture since early childhood, like people in Asia, then I believe it wouldn't be a problem. In Asia they sell lots of dried insects on street markets, and even at airports you can buy such snacks to have aboard the plane. Instead of having potato crisps, which we all know are unhealthy, we could buy bug snacks, candied ants or something like that …
- gdybyśmy byli w tej kulturze wychowani od samego początku tak jak Azjaci to podejrzewam, że nie był by to dla nas problem. Przecież sprzedaje się tam na targach masę suszonych owadów, czy nawet na lotnisku są przekąski, można kupić sobie do samolotu. Zamiast chipsów ziemniaczanych, wszyscy wiemy że są niezdrowe, takie przekąski robaczane, kandyzowane mrówki, albo coś innego…

Source: Own survey on the basis of conducted research
Źródło: Badania własne

Another group of potential consumers are sportsmen. According to some respondents, 'athletes are a specific group, strongly goal-orientated, so I suspect that they would close their eyes and eat it, just knowing how nutritious it is'.

The interviewees were asked to give their opinions regarding the information displayed on the packaging of food products containing insects as one of the ingredients. The opinions were divided. Some claimed that such information should not be highlighted, e.g. 'I think is should be hidden', 'I'd rather not know', 'it should be given in small print'. On the other hand, persons who believed the information about insect ingredients should be displayed on the packaging would rather see some data about health benefits. The respondents suggested considering concepts of some amusing graphic designs of the packaging, e.g. 'a happy worm'.

The attitude of consumers expressed in their subjective opinions suggests that some of the respondents were willing to consider insect-made dishes as potential components of their diets.

For distribution and consumption of industrially mass-produced insects as food all over the world education of the public as well as image improvement of edible insects needs to be performed in order to establish and increase consumer acceptance. Furthermore, international food regulations need to be established for food safety of insect products. Producing insects on an industrial scale requires technological improvements in rearing facilities for automated, cost-effective

production processes and the development of hygienic measures and sanitary standards[13].

Conclusions

The qualitative studies reported in this paper have shown that the knowledge of consumers about the nutritive qualities of insects is very scanty. For the sake of developing this segment of the food market, educational efforts are extremely important.

On the one hand, insects as a food ingredient evoked negative connotations; on the other hand, some consumers had a positive attitude to the dishes and food items they were shown. To accept such type of products and to overcome consumers' aversion, a key role can be played by the way they are processed, cooked and served.

Further consumer research in this scope should set an aim to determine the profile of potential consumers, willing to accept such type of food products, and these consumers are most likely to be young people and athletes.

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OWADY JAKO ALTERNATYWNA PRODUKCJA BIAŁKA I ELEMENT ZRÓWNOWAŻONEGO ROZWOJU W PRODUKCJI ŻYWNOŚCI

Streszczenie

Przedstawione w pracy badania stanowią próbę rozpoznania postaw konsumentów względem zastosowania w produkcji żywności niekonwencjonalnych surowców będących alternatywnymi źródłami białka w diecie.

Badania jakościowe przeprowadzone były metodą zogniskowanych wywiadów grupowych. Przeprowadzono dwie sesje fokusowe, polegające na swobodnej dyskusji kierowanej przez moderatora według dość ogólnego scenariusza zawierającego wyłącznie kwestie problemowe, które poruszano podczas spotkania. Poszczególne bloki scenariusza koncentrowały się na określeniu postrzegania oraz stosunku emocjonalnego wobec owadów jako surowca do produkcji żywności. W badaniu zastosowano technikę skojarzeń niekontrolowanych, polegającą na dokończeniu przez respondenta zdań związanych z luźnymi skojarzeniami, odczuciami.

Z jednej strony owady jako składnik pożywienia były negatywnie kojarzone, z drugiej zaś część konsumentów prezentowała pozytywne nastawienie w odniesieniu do przedstawianych form gotowych dań i potraw. W zaakceptowaniu tego typu produktów i pokonaniu awersji konsumentów istotną rolę może więc odgrywać sposób ich przetwarzania, przygotowania i podania.

Dalsze badania konsumenckie z tego obszaru powinny zmierzać w kierunku określenia profilu potencjalnych konsumentów skłonnych zaakceptować tego typu produkty, którymi prawdopodobnie mogą być osoby młode oraz sportowcy.

Słowa kluczowe: owady, nowa żywność, alternatywne źródło białka, konsument, postawy

Summary

The research presented in the paper is an attempt to identify consumers' attitudes towards using unconventional raw materials in food production, which are alternative protein sources in human diet.

The qualitative study was carried out with the method of focus group interviews. There were two focus sessions consisting of free discussions guided by a moderator according to quite a general scenario, which contained only the problem questions raised during each meeting. The individual blocks of problems focused on the perception and emotional attitude to insects as raw material for food production. The study involved the free association technique, in which respondents finished sentences connected with some free associations, feelings.

The qualitative studies reported in this paper have shown that the knowledge of consumers about the nutritive qualities of insects is very scanty. On the one hand, insects as a food ingredient evoked negative connotations; on the other hand, some consumers had a positive attitude to the dishes and food items they were shown. To accept such type of products and to overcome

consumers' aversion, a key role can be played by the way they are processed, cooked and served. Further consumer research in this scope should set an aim to determine the profile of potential consumers, willing to accept such type of food products, and these consumers are most likely to be young people and athletes.

Keywords: insects, novel food, alternative protein source, consumer, attitudes

Adres do korespondencji – Correspondence address
Dr Agnieszka Kosewska,
University of Warmia and Mazury in Olsztyn
Chair of Entomology, Phytophatology and Molecular Diagnostic
Prawocheńskiego 17
10-720 Olsztyn
e-mail: a.kosewska@uwm.edu.pl
tel. 89 523 41 02